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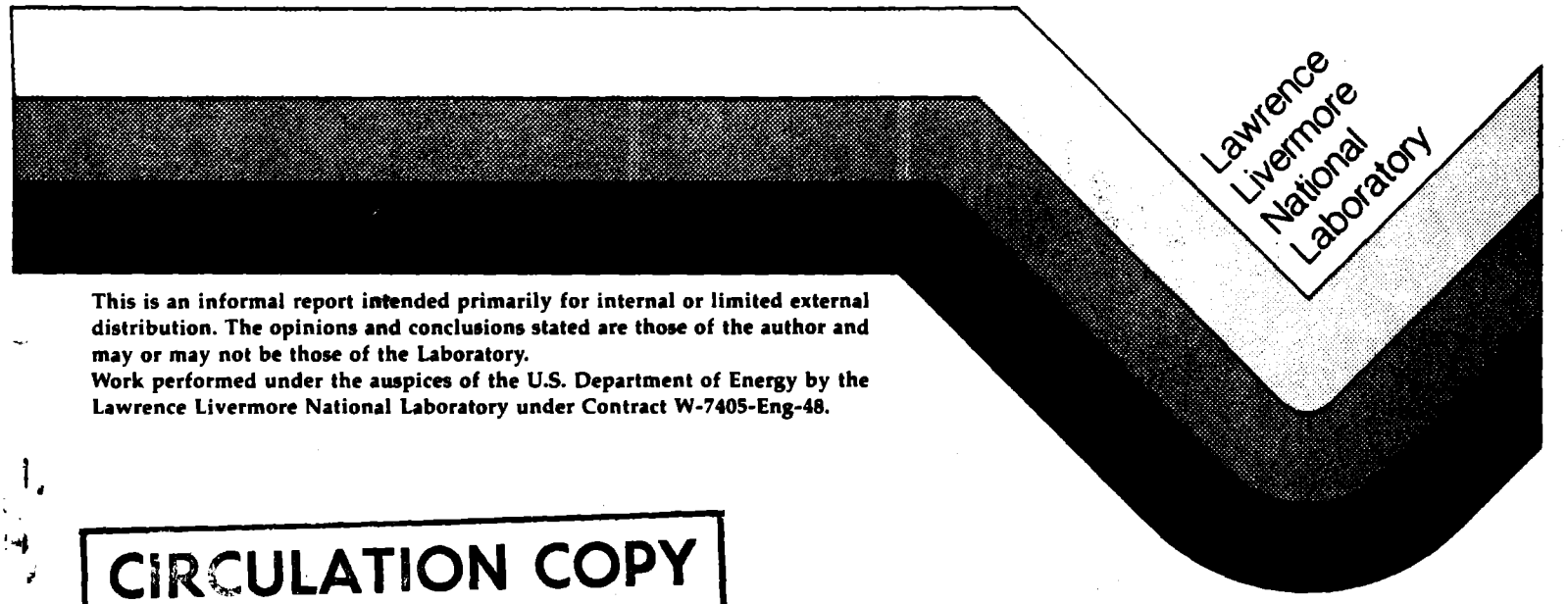

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MOLE PATROL: EDUCATION AND MEDICAL SURVEILLANCE FOR MELANOMA at the Lawrence Livermore National Laboratory

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The Lawrence Livermore National Laboratory (LLNL) is a high technology research and development facility which is located in Alameda County, California. The Laboratory employs approximately 10,000 full-time employees and contract workers. It is engaged in nuclear weapons research and development, energy research (which is primarily concentrated on magnetic and laser fusion, improved combustion of non-renewable energy resources and renewable energy resources) and biomedical and environmental research.

In 1976, Dr. Max Biggs (then Medical Director), with the help of local area physicians, identified an unusual cluster of cases of malignant melanoma among Laboratory employees. In 1977 the Laboratory requested funding for an independent study of melanoma incidence among employees by Dr. Donald F. Austin, the then head of the Cancer Epidemiology Section of the California Department of Health Services.

This study[4] observed nineteen cases of malignant melanoma among Laboratory employees during 1972 to 1977 compared to six expected cases based on rates for a population of comparable age, race, sex and census tract (as a surrogate for Social Economic Status) matched segment of the population of the San Francisco/Oakland Standard Metropolitan Statistical Area (SMSA). These findings suggested that an occupational hazard or hazards in the workplace were responsible for this increased number of melanomas, bud did not preclude social, economic and life-style factors

as possible etiologies. Additional questions raised by this report include the difficulty in obtaining a true background rate of malignant melanoma since non-hospitalized cases are not always reported. In addition, since there was some awareness of the increased number of melanomas, heightened awareness by individual employees and increased medical surveillance could also explain the increase. Subsequent studies of the LLNL and related populations set out to determine if the increase in melanoma was related to occupational factors, ecological factors, or statistical aberrations.

A follow-up study of the employees at Los Alamos National Laboratory[1] did not show an increased incidence of melanoma compared to standard incidence rates in New Mexico for the period from 1969 to 1978. There was thus no explanation of the threefold excess of melanomas found in white male employees at Lawrence Livermore. This finding was especially significant in light of the fact the both Laboratories perform similar research, have similar work forces, and are both located in sunny areas. In addition, both Laboratories are served by population-based cancer registries that participate in the SEER (Surveillance, Epidemiology, and End Results) program, and good incidence data for comparison was available.

After the first Austin study, a second study by the Cancer Epidemiology Section was funded by the Laboratory and officially published

in August, 1984 (Austin and Reynolds[2]). This case control study identified thirty-two cases of malignant melanoma among active LLNL employees during the period 1969 to mid-1980. Each case was matched to four controls, and multivariate logistic regression analysis was used to determine the importance of over 200 occupational and nonoccupational factors. Based on their analysis, Austin and Reynolds concluded that: (1) the previous report of an excess of malignant melanoma among LLNL employees was real; (2) constitutional risk factors operated equally in LLNL employees and the general population; and (3) a variety of occupational risk factors were associated with increased incidences of melanoma. These risk factors included (1) working around radioactive material; (2) one or more visits to Site 300 (a non-nuclear test site); (3) exposure to volatile photographic chemicals; (4) visits to the Pacific test site during nuclear tests; and (5) duties as a chemist. Although these conclusions were disputed at the time, the methods used in the study were validated by Kupper[11]. However, a panel of expert epidemiologists[16] reviewed the study, and did not feel that the results supported the conclusion that the occupational factors caused the excess melanomas.

A mortality study by Moore and Bennett[13], (1984) and a cancer incidence study by Reynolds and Austin[14] in 1985 show less than the expected total mortality and cancer incidence in this cohort, consistent with a healthy work affect. Moore and Bennett's study did identify malignant melanoma as a specific cause of death. However, Reynolds' and

Austin's study did examine its incidence, and found it to be statistically elevated in agreement with their previous study.

Another important study by Hiatt and Fireman[9] (which was originally presented in 1984) reviewed records from LLNL employees in the Kaiser Permanente Medical Care program. This study showed that LLNL employees without melanoma had substantially more skin biopsies. An excess number of skin biopsies was done among LLNL employees before publicity about the melanoma problem, and this excess further increased after publicity. This data is consistent with two possible explanations. Either an environmental agent increased the frequency of pigmented lesions as well as melanoma, or there was increased awareness of possible melanoma risk on the part of LLNL employees resulting in increased biopsies for suspected pigmented lesions.

THE LABORATORY'S RESPONSE

One of the suggestions in the 1984 Austin study was that the Laboratory begin both a work notification program and a screening program for malignant melanoma. In March of 1984, the Health Services Department at LLNL began an aggressive early intervention program aimed at early detection and effective treatment of malignant melanoma. This program utilized a multimedia campaign using a three-pronged approach of employee, management and local provider education; self-examination and mole counting; and an on-site melanoma clinic for dermatological examination and treatment.

I. EDUCATIONAL CAMPAIGN

The educational campaign commenced with an article in the Laboratory newspaper in March, 1984 describing the melanoma program. The three steps of the educational program included: (1) communication with management; (2) communication with employees; and (3) follow-through health services. The entire educational effort was designed to encourage Laboratory employees and contract workers to take two simple steps: examine their moles and report their findings to Health Services.

The first step was to give all managers a complete understanding of the program goals and to enlist their help in encouraging employees to participate. In coordination with the management briefing, a letter was sent to all area physicians alerting them to the Laboratory program and providing them with samples of the brochure that was sent to employees. In addition, a press conference was held to describe details of the campaign, and distribute some samples of the educational campaign material.

The second step involved communicating with the employees. The idea was stressed to the employees that early detection leads to high cure rates and 100% employee participation was sought. The employees' were requested to examine their moles and respond to the Health Services Department.

At the beginning of the employee communications phase, a telephone number (3-Mole) was activated to give information. This was advertised by posters and reminders in a weekly magazine. This magazine also carried an article introducing the "Spot Check '84" campaign. Following the article, a packet was mailed to all employees and contract workers which included a letter from the Laboratory director and the medical director, a "Spot Check" brochure explaining how to examine one's self (See Figure 1), a reply form and a return envelope marked "confidential". Once the initial

education effort was carried out, all new employees received the same melanoma information and "Spot Check" form in their new employee package.

Throughout this period, video taped reminders, posters, and luncheon lectures were used to further educate employees and encourage them to return the "Spot Check" form. Supervisors were also encouraged to have all their workers complete and return the form to the Health Services Department. Approximately two weeks after the start of the media campaign, dermatological examinations were started in the Health Services Department.

II. SELF-EXAMINATION

The "Spot Check" form was designed to encourage each employee to examine their moles. They were asked to count all marks on the skin that looked like moles and report the number, size, and location on the "Spot Check" form. In addition a letter was sent to local physicians explaining the program and asking them to biopsy all suspicious moles and send those biopsy specimens to LLNL for review by a Dermatopathologist at the University of California Melanoma Clinic. The medical department at LLNL set up a medical screening program based on self and provider referral.

Individual self-referrals resulted from increased awareness of an increase of melanoma at the Laboratory, and by the criteria on the "Spot Check" form.

Employees reporting five or more moles greater than five mm in diameter (the size of a pencil eraser), or one mole eighteen mm in diameter (the size of a dime) on self-examination were considered to have an elevated risk of developing melanoma.[4] These employees were asked to make a routine appointment to be screened. Employees with a changing pigmented lesion were asked to make an immediate appointment.

People were not required to report to the medical department for treatment, but were encouraged to see any doctor, either at the Laboratory or their own private physician. In addition, all medical providers at the Health Services Department were specifically trained to look for unusual skin lesions and refer them to the dermatologist.

III. DERMATOLOGICAL EXAMINATION

Once high risk individuals are identified, they are referred to dermatologists from the University of California San Francisco (UCSF)

Melanoma Clinic who performed examinations two days a week at LLNL. These dermatologists worked with a dermatopathologist at the UCSF Melanoma Clinic to review biopsy specimens of all LLNL cases. Individuals are referred to the dermatologist for examination and biopsy of any suspicious lesion. Persons with numerous moles, dysplastic moles or previous melanoma receive a photographic survey and are placed on a routine follow-up schedule.

Repeated emphasis is made that any suspicious mole or any changing mole should immediately be reported to one of the physicians at the medical department for evaluation. These examinations are recorded on a specific form that was developed for the Melanoma Clinic at UCSF (Figure 2).

RESULTS

Figure 3 shows the percentage of employee participation. Figure 4 shows the number of new patients examined in the dermatology clinic by type of referral and Figure 5 indicates the total number of melanomas diagnosed among LLNL employees.

There are some important successes that have come out of the LLNL Melanoma Program. An important outcome of the program is that the work force senses that this is an appropriate response to the melanoma problem and feels that the institution is taking a concerned interest in a potential medical problem. This has resulted in a general decrease in the anxiety level of employees in the institution about the melanoma problem.

The epidemiology of malignant melanoma is complex. Melanoma does not seem to be directly related to total sun exposure, but may involve multiple elements such as age of exposure, susceptibility to sun burn, and degree of sunburn[3,4,7,10,12]. Since 1984, all lesions that have been discovered and removed at the Melanoma Clinic have been thin lesions (Schneider[15], et al 1987). Increased screening at the Lab has been associated with an increased proportion of thin tumors and an increased number of in situ lesions. Figures 6 and 7 show LLNL has had a consistently thinner lesion than a local pathology laboratory, even before the program started and this trend has increased. By reducing the absolute number of melanoma greater than 0.75 mm in thickness, we may decrease the overall mortality from malignant melanoma at Lawrence Livermore.

Studies by Cristofolini[5], English[6], and Green[8] suggest that areas in Australia with the highest rates of malignant melanoma also have the highest percentage of in situ melanoma cases. The series by

Schneider[15] is the thinnest series reported in the literature, and suggests that increased awareness in the population and medical screening efforts lead to early diagnosis of melanoma and decreased thickness which ultimately leads to low mortality rates.

SUMMARY

Experience with the melanoma surveillance program to date has shown that self-examination of skin lesions can result in identification of a population at increased risk for melanoma. Early identification provides an opportunity for excision of the lesions with an increased expectation for cure. This program can be relatively inexpensive since it relies on self examination and appropriate follow-up referral by professional staff.

Figure 1 LLNL "Spot Check" Form

Figure 2 Melanoma Clinic Report Form

Figure 3 Employee participation of current active LLNL employees by type of interaction

Figure 4 Number of new patients examined in the LLNL melanoma clinic by type of referral. Initially all patients were self-referred. The dramatic rise in total patients during July to December, 1985 is explained by the influx of high risk patients. The current patient mix is roughly half self- and half HSD staff-referred.

Figure 5 Number of melanomas diagnosed among active LLNL employees 1960-1988. 1960 was the first year in which a melanoma appeared among Laboratory workers. AMH is atypical melanocytic hyperplasia, believed to be a premelanotic lesion.

Figure 6 Tumor thickness by year of diagnosis for LLNL melanomas. All tumors were submitted to Dr. Richard Sagebiel, dermatopathologist at UC San Francisco, for review. Tumors thinner than 0.76 mm have 95-100% 5-year survival rates. Both in situ and AMH have 0 tumor thickness.

Figure 7 Average tumor thickness by year of diagnosis for LLNL melanomas compared to average thickness from a nearby community-based pathology laboratory. LLNL lesions are thinner, and tumor thickness decreased at a faster rate.

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Help Us Help You!

Tell Us What You Find On Your Skin

After you have read the enclosed brochure on malignant melanoma, please take a minute to complete this form. Put it into the postage-free confidential envelope provided and mail today.

Examine your skin for moles, then complete the chart below. If you find any moles, indicate where they are on your body, and their size and number

	Smaller than 5mm	5mm–18mm	18mm or larger
Head and neck			
Arms			
Legs, including buttocks			
Chest down to the lowest rib			
Abdomen, excluding genitals			
Back			
Genitals			
Total			

In addition, please check at least one of the boxes below.

- You will be examined as soon as possible if you check either or both of the boxes below:

☐ I have examined my skin and have found a mole that has changed.
I will call 3-MOLE immediately.

☐ I have examined my skin and have found a spot or bump that worries me
I will call 3-MOLE immediately.

- You will be examined in our screening program if you check the box below:

☐ I have examined my skin and found one or more **very large** moles — measuring 18 mm in diameter (dime-sized) or larger.
Please call me to set up an exam.

☐ I have examined my skin and have found none of the above

☐ I am in a high-risk group, but I prefer to see my own physician

_____
Doctor's name

_____
City

_____
Address and phone number, if available

Name _____

Address _____

_____

examform

NAME:_____ #_____ DATE_____

PRESENTING COMPLAINT: self staff high risk

MEL MLS DYl DY2 DY3 SEB KER WAR ACT BAS SQU VAS INF FLA

PIG SKI FH MOLES: NORM LAR RAI IRR CHA NUM _____

PRESENTING LESION:

F.H.	a) large # of moles	f	m	s	s	b	b	d	d	sn	sn	_____	u
	b) abnormal looking moles	f	m	s	s	b	b	d	d	sn	sn	_____	u
	c) dysplastic moles	f	m	s	s	b	b	d	d	sn	sn	_____	u
	d) previous mole excised	f	m	s	s	b	b	d	d	sn	sn	_____	u
	e) melanoma in family	f	m	s	s	b	b	d	d	sn	sn	_____	u
	f) pre-cancer(nonmelanoma)	f	m	s	s	b	b	d	d	sn	sn	_____	u
	g) skin cancer	f	m	s	s	b	b	d	d	sn	sn	_____	u
	h) none												

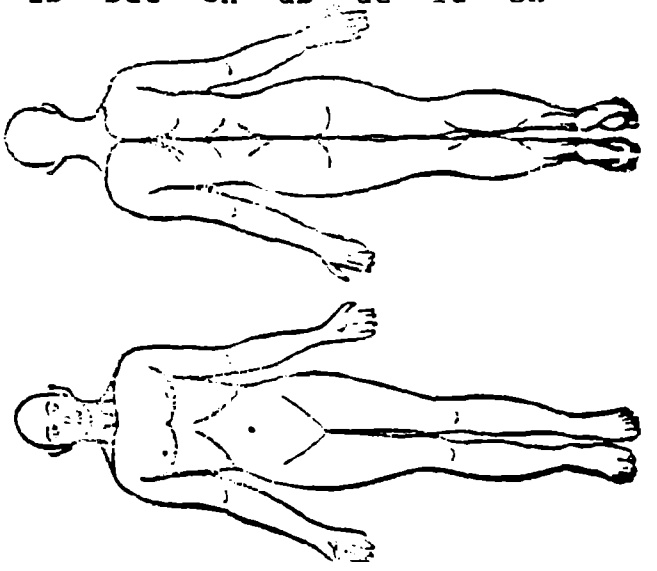
P.M.H. a) dysplastic moles
b) previous mole excised
c) previous hx of melanoma
d) previous hx of pre-cancer(nonmelanoma)
e) previous hx of skin cancer(nonmelanoma)
f) none

SKIN TYPE: I II III IV V VI
burns I II III VI tans I II III IV
HAIR: red blond lt.brown brown dk brown black
EYE: 1 2 3 4 5 6 7 8 9 10 11 12

	y	n
MOLES: none few(1-25) mod(26-50) many(>50) __	Cong. N._____	_____mm
>5mm MOLES: none few(1-5) mod(6-10) many(>10) __	Cafe _____	_____mm
FRECKLES: none few mod many	N.Spilus_____	_____mm
LENTIGINES: none few mod many	Blue N._____	_____mm

DMN: none possible probable definite
few(1-5) mod(6-10) many(>10)
small(<6mm) med(6-11mm) lrg(11-20mm) vlrg(>20)
location: predom scalp hn ub lb but ch ab ue le pp
other scalp hn ub lb but ch ab ue le pp

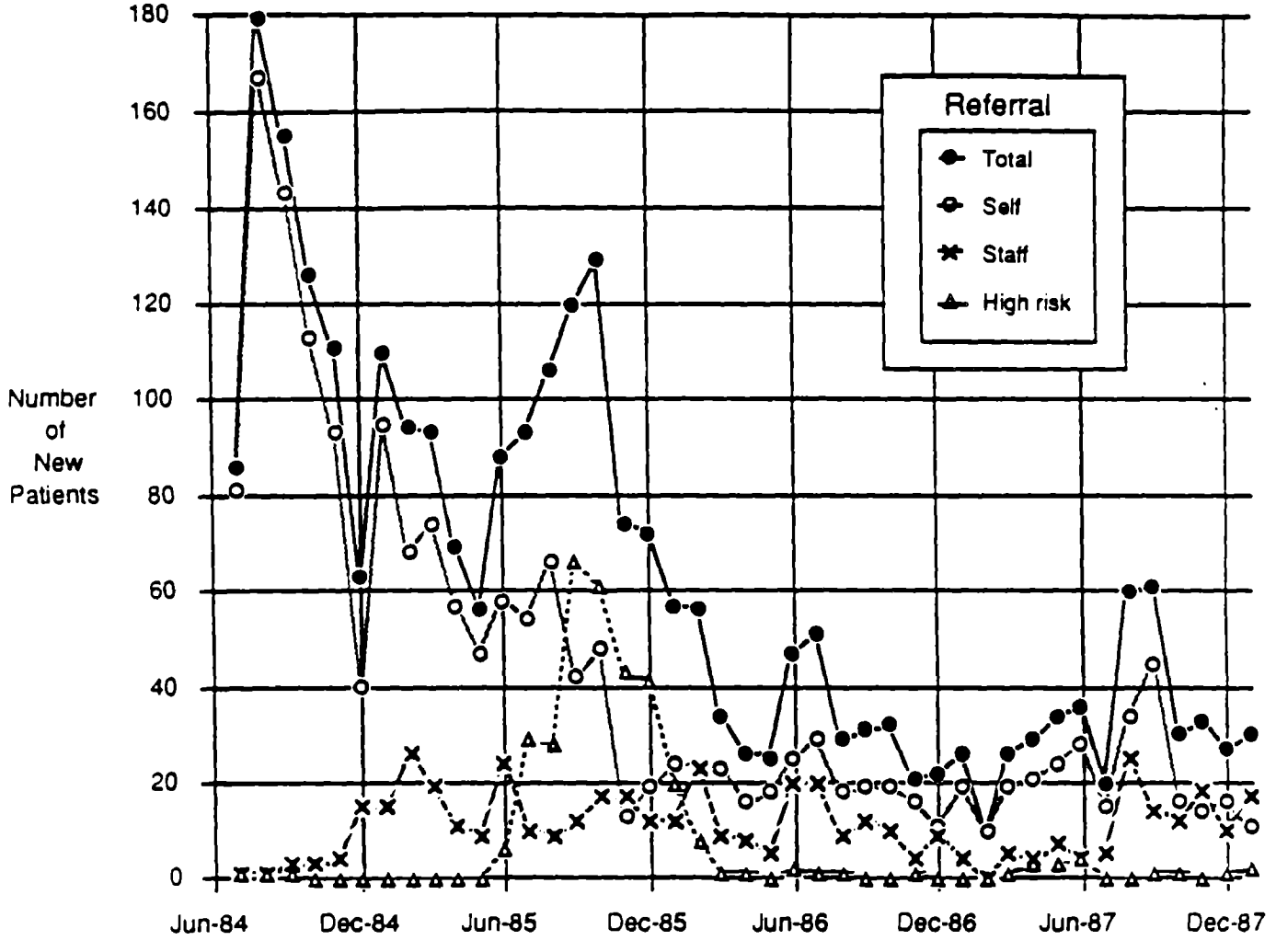
OTHER Dx:

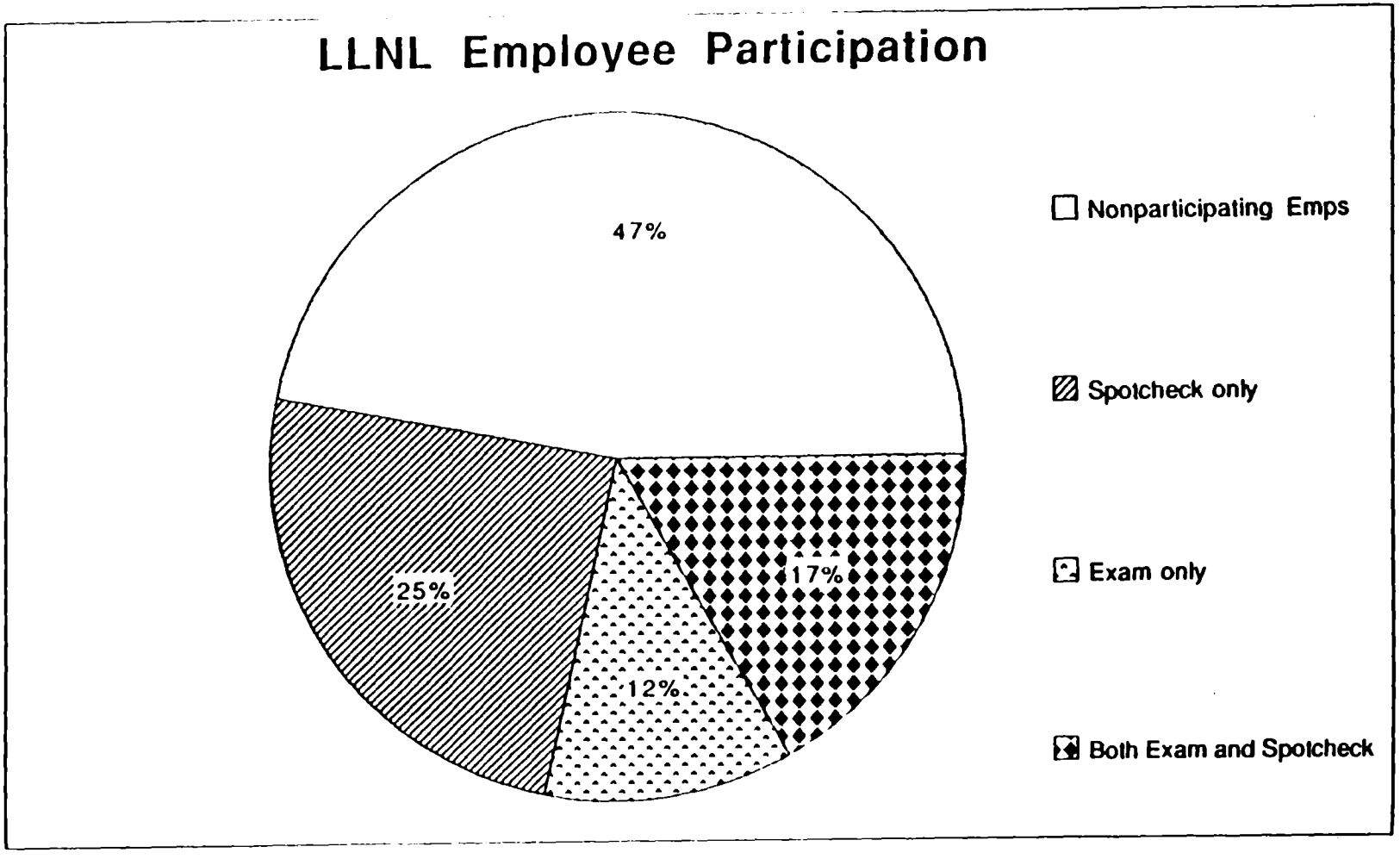


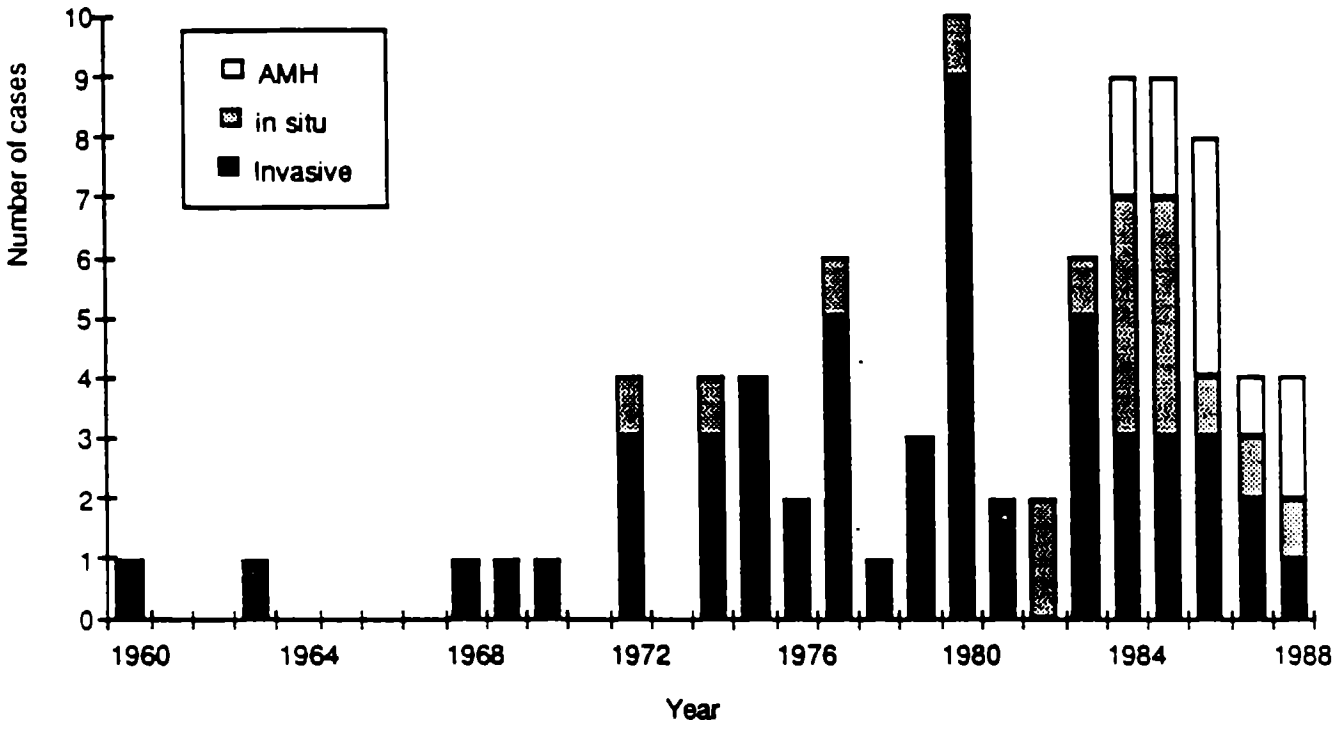
DNS TYPE: by hx- 1A 1B 1C 1D1 1D2
clin - 2A 2B 2C 2D1 2D2
path - 3A 3B 3C 3D1 3D2

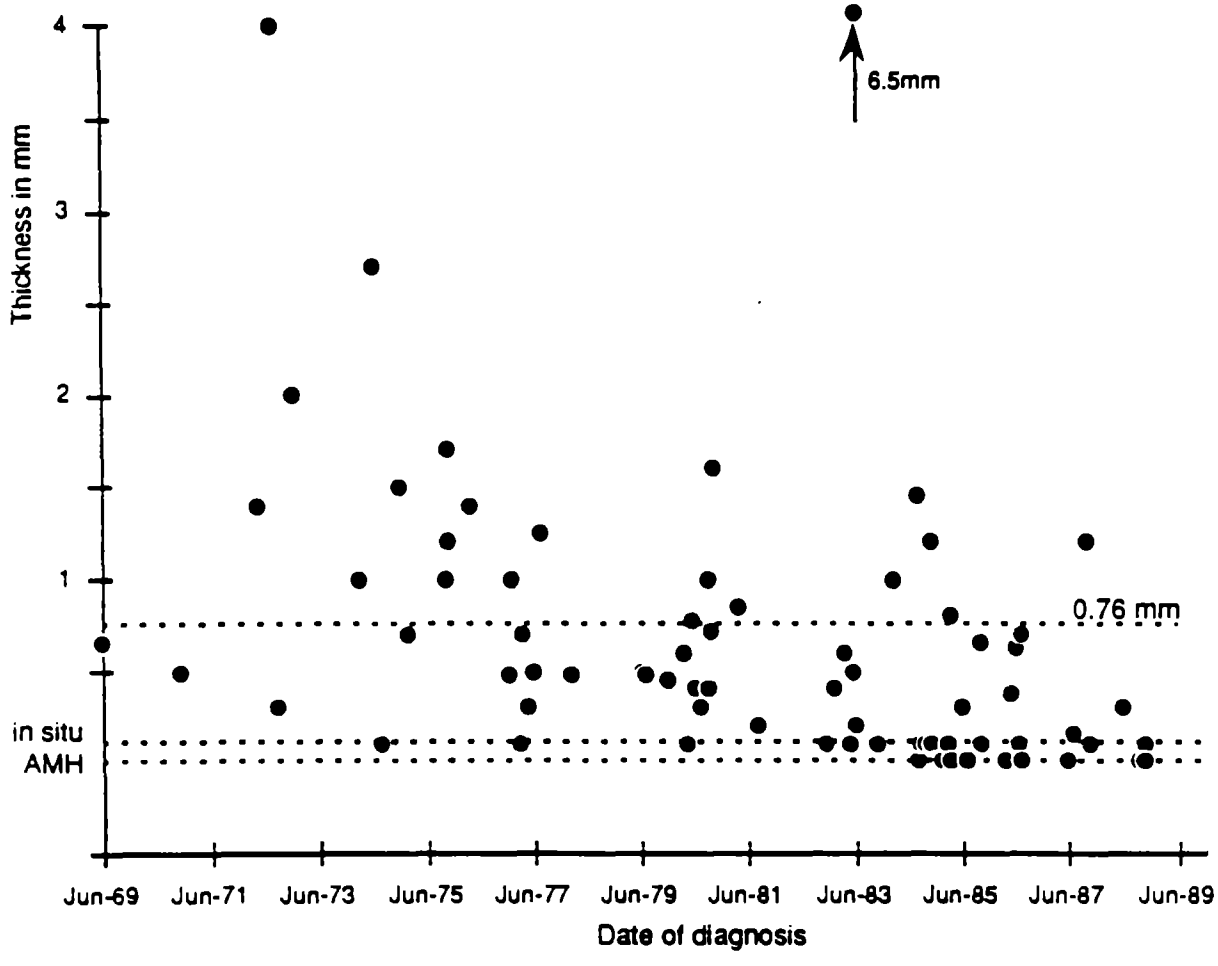
PLAN: bx high risk mod risk

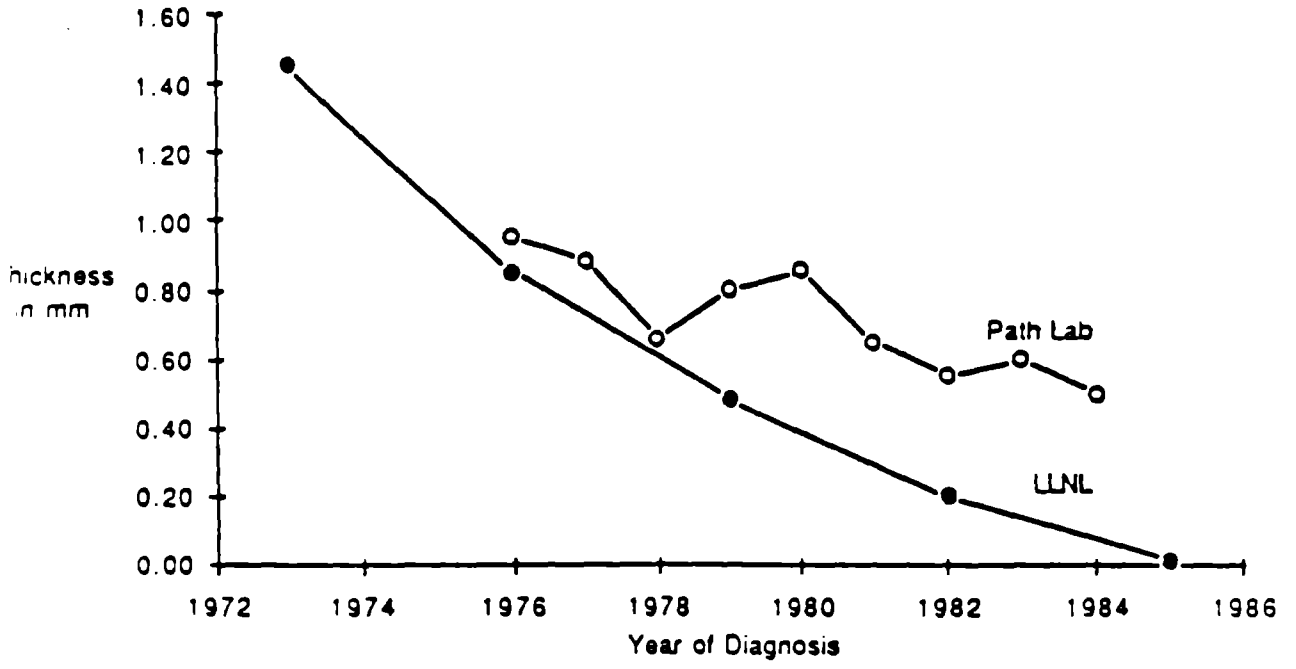
low risk re-assure recheck


Referral
Total
Self
Staff
High risk
Number of New Patients
180
160
140
120
100
80
60
40
20
0
Jun-84
Dec-84
Jun-85
Dec-85
Jun-86
Dec-86
Jun-87
Dec-87


LLNL Employee Participation
47%
25%
12%
17%
Nonparticipating Emps
Spotcheck only
Exam only
Both Exam and Spotcheck


AMH
in situ
Invasive
Number of cases
0
1
2
3
4
5
6
7
8
9
10
1960
1964
1968
1972
1976
1980
1984
1988
Year


4
3
2
1
Thickness in mm
6.5mm
0.76 mm
in situ
AMH
Jun-69
Jun-71
Jun-73
Jun-75
Jun-77
Jun-79
Jun-81
Jun-83
Jun-85
Jun-87
Jun-89
Date of diagnosis


1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
hickness
n mm
Path Lab
LLNL
1972
1974
1976
1978
1980
1982
1984
1986
Year of Diagnosis